

Welcome to the 3rd Annual Review of the CFNS Despite COVID

2020 has been a demanding year for all on many fronts, foremost due to COVID.

I am glad to see you all for this review, which indicates that you and your's are healthy and engaged in science.

Let's hope 2021 is a recovery year from COVID-19 and the 4th Review can be held in person.

Stay Safe!

Abhay Deshpande

Center for Frontiers in Nuclear Science in 2020

- Some background and reminders
- Activities of the Center in 2020
- Looking back (summaries of to-do's) & into the future to 2021



**Center for Frontiers
in Nuclear Science**

<https://www.stonybrook.edu/cfns/>

Founded in September 2017

Simons Foundation support till 2027
+ NY State : Renovations at Stony Brook
+ BNL : Renovations at BNL (Seminar Room)

Vision:

A Center for all scientists interested in the US
Electron Ion Collider (& Nuclear Science)

A “home” for

- scientific discourse and
- attract & support young scientists
- help seed future collaborations

Work with the EIC Users Group & the two Labs, to
help realize the US Electron Ion Collider.

Expand the scientific activities beyond EIC at a later
time

CFNS was setup in September 2017, started operations in 2018

You are reviewing the Center's 3rd year of activities (2020)

EIC Status and Realization

- CD0 : December 19, 2019
- Site BNL : January 9, 2020
- BNL and JLab realize EIC as partners
- A formal EIC project is now setup at BNL
- BNL+Jlab management & scientists are working together to realize it on a fast timeline.
- **CD1 anticipated March 2021**
- **CD2 September 2022 (final design)**
- **CD3 4th Quarter FY2023 (start construction)**
- EIC CD4A Early Finish 4th Q FY2029
- EIC CD4B 3rd Q FY 2032

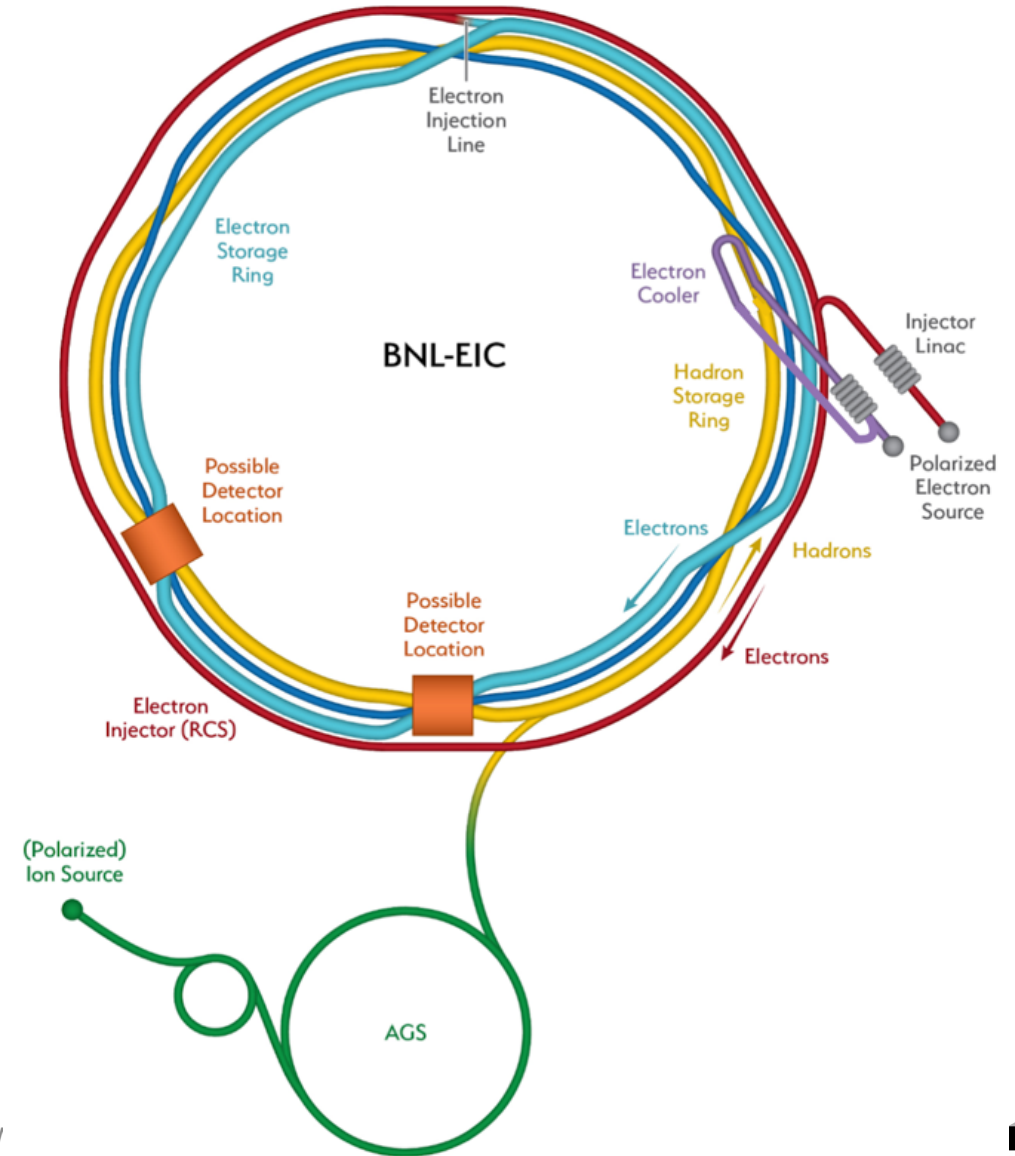


[Home](#) » U.S. Department of Energy Selects Brookhaven National Laboratory to Host Major New Nuclear Physics Facility

WASHINGTON, D.C. – Today, the **U.S. Department of Energy (DOE)** announced the selection of Brookhaven National Laboratory in Upton, NY, as the site for a planned major new nuclear physics research facility.

EIC Status and Realization

- CD0 : December 19, 2019
 - 1 machine, 1 IR and 1 Detector with a *possibility of of a second IR and Detector*
- Site BNL : January 9, 2020
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CFNS Governance

- **International Advisory Committee (Review Center Operations)**

- A. Caldwell (MPI), L. Elouadrhiri (JLab), B. Jacak (UCB/LBNL), X. Ji (UMD/CNF), Y. Kovchegov (OSU), Z.-E. Meziani (ANL), R. Milner (MIT, Chair), B. Mueller (Duke), W. Nazarewicz (MSU), P. Newman (Birmingham), B. Pasquini (Pavia), F. Pilat (ORNL), J. Qiu (JLab), G. Sterman (SBU/YITP), W. Vogelsang (Tubingen)
- Ex. Officio: R. McKeown (JLab), Dmitri Denisov (BNL), B. Surrow (Chair, EICUG-SC)
- Optional rotation of 1/3 committee in 2021

- **Program Advisory Committee (Review/recommend Workshops)**

- M. Diehl (DESY), C. Keppel (JLab), K. Kumar (U. Mass.) P. Shanahan (MIT), F. Yuan (LBNL)
- Optional rotation of 1/3 committee in 2022

Governance and day-to-day operation

- **Director:** Abhay Deshpande
- **Scientific Coordinators:** Ciprian Gal (SBU) & J.H. Lee (BNL)
- **CFNS Steering Committee** (Help implement IAC's advice & run local activities)
 - A. Deshpande (SBU/BNL, Chair) T. Hemmick (SBU), D. Kharzeev (SBU/BNL), [J. Kiryluk \(SBU\)](#), [L Ruan \(BNL\)](#), T. Ullrich (BNL), R. Venugopalan (BNL, Co-Chair), Ex officio: C. Gal (SBU) & J. H. Lee (BNL)
- **Seminar Coordinators:**
 - [Sanghwa Park \(SBU\)](#), Yong Zhao (BNL>ANL), Jinlong Zhang (SBU>SDU), Adrian Florio (SBU)
- **Administrative Assistants:**
 - [Socorro Delquaglio \(SBU\)](#), [Rachel Inguenta \(BNL\)](#) [Marlene Vera-Vitteri \(SBU\)](#)

CFNS Activities in 2020

Most activities continued on remote utilities like Zoom & BlueJeans

- SBU-BNL [Joint Seminars](#) : 2/month alternate between BNL and SBU (moot in 2020)
 - Has now been made formally a graduate course at Stony Brook (PHY 674)
- CFNS [Workshops and Adhoc Meetings](#)
 - 13 events planned, 11 executed, 2 postponed to 2021
- CFNS post-doctoral fellow program
 - Hired at BNL hired in 2018/9 (~5)
 - Hired at Stony Brook between 2019-2021 (4)
 - Joint CFNS-Remote Institute, hired between 2019-2020 (~5)
- Short- & long-term visitor program (did not happen in 2020)
- 2nd CFNS summer school (did not happen but will be merged with 2021-School)
- Initiating programs to support under-represented minorities (URMs)

Total of 750-1000 visitors at the Center through the remote activities

CFNS Seminars 2020

Sanghwa Park (SBU/Ex)
Jinlong Zhang (SBU/Ex)
Yong Zhao (BNL/Th)
Adrian Florio (SBU/Th)

| | |
|-------------------|---|
| November 12, 2020 | Liupan An: Studies on exotic hadrons at LHCb |
| October 15, 2020 | Xiaoxuan Chu: Signature of gluon saturation: from STAR to EIC |
| October 1, 2020 | Pawel Nadel-Turonski: A novel compact detector concept for the Electron-Ion Collider |
| August 20, 2020 | Raju Venugopalan: Separating fact from fantasy in the proton's spin*: the chiral anomaly and the proton spin puzzle |
| August 6, 2020 | Raghav Kunnawalkam Elayavalli: Era of Jet-SubStructure and its utility in high energy collisions |
| July 2, 2020 | Yuri Kovchegov: Small-x Contribution to the Proton Spin Puzzle |
| June 18, 2020 | Felix Ringer: The dynamics of leading jets and the jet energy loss |
| June 11, 2020 | Salina F. Ali: Towards Femtography of the Nucleon: Neutral Pion Electroproduction in the Deeply Virtual Regime |
| May 7, 2020 | Miguel Arratia: Jets at the EIC |
| March 12, 2020 | Vladimir Skokov: Entanglement, partial set of measurements, and diagonality of the density matrix in the parton model |
| Feb 28, 2020 | Axel Schmidt: Short-range correlations and the nuclear forces at short distances |
| Feb 20, 2020 | Michael Engelhardt: Advances in quark transverse dynamics in the proton from Lattice QCD |
| Jan 30, 2020 | Caryn Palatchi: Controlling Electron Beam Asymmetries in the Lead Radius Experiment |
| Dec 12, 2019 | Kiminad Abebe Mamo: Diffractive photoproduction of J/ψ and Y using holographic QCD: gravitational form factors and GPD of gluons in the proton |
| Dec 10, 2019 | Vladimir N Litvinenko: High-Energy High-Luminosity e^+e^- Collider using Energy-Recovery Linacs |



CFNS Workshops:

Open call for workshops in February, Deadline June,

Workshops selected by July 1st with the help of the CFNS Program advisory committee consisting off

M. Diehl (DESY), C. Keppel (Jlab), K. Kumar (Umass), P. Shanahan (MIT) & F. Yuan (LBNL)

CFNS Workshops 2020

| | |
|----------------------|---|
| December 5-6, 2019 | CFNS Annual Review Organizers: A. Deshpande, C. Gal, J.-H. Lee, S. Delquaglio, M. Vera-Viteri |
| January 21-24, 2020 | Exploring QCD with light nuclei Organizers: A. Deshpande, R. Dupre, M. Patsyuk, M. Sergsian, M. Strikman and C. Weiss |
| March 23-27, 2020 | International Conference on Deep Inelastic Scattering (DIS), Stony Brook host. Brooklyn, NY Organizers: A. Deshpande and IAC and LOC Event cancelled due to COVID, will host this again virtually in April 2021. |
| May 6-7, 2020 | Electroweak Physics at the EIC Organizers: W. Deconinck, Y. Furlanova, C. Gal, M. Gericke |
| June 1-5, 2020 | Workshop on Pion and Kaon Structure at the EIC Organizers: Tanja Horn, Craig Roberts et al. |
| June 26-July 1, 2020 | Beam polarization and polarimetry at the EIC Organizers: E. Aschenauer, D. Gaskell, V. Morozov, V. Ptitsyn, F. Willeke, C. Gal. |
| July 9-10, 2020 | Radiative Corrections in e-p, e-A scattering at the EIC Organizers: J. Bernauer, J. Friedrich, H. Gao and R. Milner |

| | |
|-----------------------|--|
| September 28-30, 2020 | Ad hoc/Workshop: Ad hoc - Target Fragmentation Physics with EIC Location: online Organizers: J.-H Lee(BNL), Marta Ruspa (U. Piemonte Orientale Novara/INFN Torino), Anna Stasto (Penn State), Mark Strikman (Penn State), Christian Weiss (Jlab) |
| November 4-6, 2020 | Ad hoc/Workshop: CFNS Ad hoc Meeting/Workshop Proposal: Opportunities with Heavy Flavor at the EIC Location: online Organizers: J. Huang (BNL) Xi. Li (LANL), F. Olness(SMU), I. Vitev (LANL), C. Weiss (JLab) |
| December 15-16, 2020 | CFNS Ad hoc: Pre-meeting for the 2nd IK workshops in 2021 Location: online Organizers: L. Elouadrhiri, V. Burkert, M. Contalbrigo, A. Deshpande, H. Gao, R. Milner, B. Jacak, T. Satogata, F. Sabatie, B. Surrow |

CFNS Workshops 2021 (incomplete list)

| Date | Upcoming Events |
|----------------------|---|
| January 25-29, 2021 | Ad hoc meeting: EIC physics in the Snowmass process Location: online Organizers: Swagato Mukherjee et al., and A. Deshpande, C. Gal |
| February 2, 2021 | Review: Online CFNS Annual Review Organizers: A. Deshpande, C. Gal, J.H. Lee for the EICUG Steering Committee |
| March 18-22, 2021 | Workshop: CPAD Instrumentation Frontier Workshop 2021 Location: (online) Stony Brook, New York Organizing Committee: Marina Artuso (Syracuse University), Rick Van Berg (University of Pennsylvania), Klaus Dehmelt (Stony Brook University), Prakhar Garg (Stony Brook University), Roxanne Guenette (Harvard University), Karsten Heeger (Yale University), Petra Merkel (Fermilab), Ian Shipsey (Oxford, International Advisor, IID chair), Jinlong Zhang (Argonne National Lab) |
| April 12-16, 2021 | Conference: Deep Inelastic Scattering Location: (online) Stony Brook, New York Organizing Committee: Elke Aschenauer (BNL), Abhay Deshpande (SBU/BNL, Chair), Rolf Ent (JLab), Yulia Furletova (JLab), Tanja Horn (CUA), Joanna Koryluk (SBU), Fred Olness (SMU), Giacinto Piacquodidio (SBU), Lijuan Ruan (BNL), Bernd Surrow (Temple U.), Thomas Ullrich (BNL), Raju Venugopalan (BNL), Rik Yoshida (ANL) |
| April, 26-29, 2021 | Workshop: Open Questions in Photon-Induced Interactions-from Relativistic Nuclear collisions to the Future Electron-Ion Collider Location: Stony Brook University (pandemic allowing) Organizers: Wei Li, Bjoern Schenke, Zhoudunming Tu, Thomas Ullrich |
| May 24-27, 2021 | Workshop: RHIC Science Programs Informative Toward EIC in the Coming Years Location: Stony Brook University (pandemic allowing) Organizers: C. Aidala, Alexander Bazilevsky, Maria Chamizo Llatas, Xin Dong, Oleg Eyser, Yugi Goto, Jin Huang, Rosi Reed, Bjoern Schenke, Matt Sievert, Qinghua Xu, Zhangbu Xu |
| June 16-18, 2021 | Workshop: The 2nd Workshop on Jets for 3D Imaging at the EIC Location: Stony Brook University (pandemic allowing) Organizers: Miguel Arratia(UC Riverside, Chair), Renee Fatemi (U. of Kentucky), Zhongbo Kang (UCLA/CFNS), Brian Page(CFNS/BNL), Alexei Prokudin(JLab/PSU Berks), Felix Ringer (LBNL) |
| September 6-10, 2021 | Workshop: AI4EIC-Ex-Experimental Applications of Artificial Intelligence for the Electron Ion Collider Location: Stony Brook University (pandemic allowing) Organizers: A. Boehnlein (JLab) C. Fanelli (MIT), T. Horn CUA) J. Bernauer (SBU) |
| TBD, 2021 | Workshop: The Science and Instrumentation of the second Interaction Region for the Electron -Ion Collider(EIC) Location: CFNS-ANL, CFNS-Europe, CFNS-CNF (Stony Brook & Washington DC) Organizers: Volker Burkert, Marco Contalbrigo, Abhay Deshpande, Latifa Elouadrhiri, Haiyan Gao, Barbara Jacak, Richrd Milner, Franck Sabatie, Todd Satagota |



Post Doctoral & student Program 2020

Mentors in (brackets), graduations in bold

- Post doctoral fellows @ BNL in 2020 (5)
 - Kolja Kauder (TU), **Alba S. Ontoso(RV)**, **Abha Rajan (YH)**, Kong Tu (TU), Renaud Boussarie (RV)
- Post doctoral fellows @ Stony Brook in 2020/21 (4)
 - Barak Schmookler (ALD), Mriganka Mondal (ALD), **Esha Roli (AD)**, **Zuhal Demiroglu (new, ALD)**
- Joint CFNS-Remote institutions (PI's propose, Director & SC evaluate, opportunities)
 - Dingyu Shao (Z. Kang, UCLA), Andrei Tarasov (Y. Kovchegov, OSU), Vitali Baturin (C. Hyde, ODU), **Caryn Palatchi** (K. Paschke, UVa), **Yang-Ting Chien** (G. Sterman, SBU/YITP)
 - Others: **B. Jacak** (UCB), X. Ji (UMD), **S. Dalla Torre** (INFN)
- Graduate students at Stony Brook supported:
 - Ph.D.: Kaushik Roy (RV), Farid Salazar (BS)
 - MA Sr. Thesis **Athira K.V.** (ALD)

ALD : Abhay D.
AD : Axel Drees
RV : Raju V.
BS. : Bjoern Schenke
YT : Yoshitaka Hatta
TU. : Thomas U.

Summary of scientific output 2020

by post-docs and students supported by CFNS

Publications including submitted papers:

- 85 publications in a variety of international journals:
- PRL, PRD, PRC, NIM, Hadr. Sp.& Str., EPJC, JHEP, PLB, Nature, Science, Chin. Phy. C

Talks given:

- 55 talks (25 contributed, 22 seminars, 8 invited/plenary) @ national and international meets and departmental seminars

Workshops organized:

- 9 workshops/conferences organized

EICUG Yellow Report & CFNS

See details in Thomas Ullrich's talk

EIC UG led a year-long series of 5 workshops (December 2019 at MIT, March 2020 @Temple, May 2020 @Pavia, September 2020 @CUA & November @UCB)

- Aim: to organize the EICUG to help/start design a detector for the EIC science

CFNS Experimentalists

- Post Docs (Kauder, Tu, Schmookler, Mondal, Esha, Baturin, Palatchi) and student (Athira) were deeply involved in the Yellow Report studies of diverse working groups: inclusive, exclusive, diffractive/tagging, and detector oriented PID, far-forward detection, DAQ & Electronics, Central detector & e-polarimetry.
- Page, Fazio, Park, (Sr. : past CFNS or affiliates) & experimental faculty/scientists Bernauer, Deshpande, Hemmick, Ullrich, Lee, Gal also contributed variously.
- **Leadership:** Schmookler (Convener), Hemmick (Convener) & Ullrich (Coordinator)

CFNS Theorists:

- Postdocs (Soto, Rajan, Chien, Boussarie) & students (Roy & Salazar) discussions in the Physics WG with Schenke, Serman, Venugopalan, Kharzeev, Zahed

Graduations from CFNS 2020

| Name | Position at CFNS | Where in 2021 |
|------------------|-------------------------------|---|
| Kolja Kauder | CFNS Post Doc (Exp) | Sr. Post Doc BNL N&P Software Group |
| Alba Soto Ontoso | CFNS Post Doc (Th) | Sr. Post Doc/Researcher IPhT-Saclay |
| Abha Rajan | CFNS Post Doc (Th) | Sr. Post Doc ODU/JLab |
| Kong Tu | CFNS Post Doc (Ex) | BNL Goldhaber Fellow |
| Renaud Boussarie | CFNS Post Doc (Th) | LANL Oppenheimer Fellow CNRS Ecole Polytechnique Paris |
| Dingyu Shao | CFNS-UCLA Post Doc (Th) | Assistant Professor, Fudan U. |
| Yang-Ting Chien | CFNS-YITP Post Doc (Th) | Assistant Professor, Georgia State U. |
| Athira K. V. | MA CFNS-ISER (Ex) | Graduate Student @Temple U. |
| Jinlong Zhang | SBU Post Doc (CFNS Affiliate) | Associate Professor Shandong U. |
| Kaushik Roy | Ph.D. Students (SBU) | Post Doc at LMU |

Other CFNS initiatives in infancy

Research Initiatives : Data analysis of HERA data

- Significant sets of H1 and ZEUS data from 2003-2006 have not been analyzed
- New theoretical ideas and formalisms have developed over the past 10 years
- H1 and ZEUS collaborations welcome young EIC-oriented scientists getting involved in analyses of their data and get them published.
- Ideal analyses & experience for Masters & Ph.D. students & post docs interested in EIC
- CFNS could partially support such an initiative (currently 1@BNL & 2@SBU CFNS post docs involved, this will grow) – broader interests and activities at UCR, Yale, Temple

New Center for Nuclear Femtography at SURA

- With Xiangdong Ji as its Director & supported by the state of Virginia and SURA, the Center is aimed at bringing experts in NP, Computing, mathematics and visualization together.
- Ideas for possible collaboration between CFNS and CNF are being explored.

Teaching initiatives with EIC² @ JLab

- Prepare pedagogical lecture (core set of lectures) and EIC Simulation Software tutorials
- Aimed at general & Specific needs: Test-balloon (M. Diefenthaler, D. Higinbotham & A. Deshpande)
- Early March 6 2-hr lectures (pedagogy EIC Science, measurements & detectors) for India
- Will learn and will grow to directed regional audiences (for example: Africa, Latin America, East Asia)

Initiatives for under-represented minorities

Details in the afternoon a separate short presentation

Edward Bouchet Initiative for QCD: NSF Traineeship for **graduate students**

- **Source:** Seven minority serving institutions: CUNY, Florida A&M U., Hampton U., Howard U., Navajo Tech., Texas Southern, and U. of Puerto Rico
- BNL, Jefferson Lab, and MIT, UMass Amherst, UVa, Yale and Stony Brook/CFNS) (Deshpande: PI)
- MA/MSI at SBU/CFNS. Research, including potential Ph.D., with Co-PI's any of the participating institutions at BNL or JLab.
- Proposal made through all-but final hurdle. Unsuccessful, but constructive comments by reviewers, will apply again for 2021. (Will expand group – more interest)

BNL-MSI Fellowship Program for Research Excellence in NP for **undergraduate students DOE**

- Source: Florida A&M, Howard U., Morgan State, Texas Southern, U. of Puerto Rico
- Students come to BNL for summer research & continue for two more semesters, optionally take 2 advanced UG courses at Stony Brook, which may not be available at their institutes: **CFNS will pay tuition if not affordable.**
- M. Chiu (PI), A. Deshpande (Co-PI)+ ~8 scientists at BNL in different aspects of nuclear physics

Before we conclude: To-Do's from last year

from IAC Report 2019

- Setup CFNS program committee for Workshop evaluation and make it functional.
 - **DONE and operational**
- Prepare a charter and get it formally approved by IAC
 - **Draft produced and circulated in the IAC – approval today(?)**
- Initiate pro-actively diversity initiatives
 - **Direct CFNS hires had gender balance (45:55), have initiated 2 initiatives for other diversity concerns**
- Clarify mentors of Post Docs at CFNS
 - **Done. Mentors clearly identified.**
- Recommendation to SBU Physics: increase NP faculty
 - **Discussed faculty hires at SBU in the context of EIC becoming real. High priority Theory hire ~2022, Exp. Hire ~2025**
- Working with the EIC UG post CD0
 - **Significant contributions from CFNS in to the EIC UG's Yellow Report**
 - **Will continue to work through workshops and other help to develop detector proposals**

Incomplete (on-going) To-Do's

- BNL Support for post-docs post CD0 of EIC is a difficult problem to solve. Currently an LDRD (PI's: Deshpande & Ullrich) supports people working closely working with EIC development at BNL. **Abhay + CFNS-SC will work with new ALD.**
- Making one of the SBU administrative assistant full time has not succeeded yet. Hiring freeze at the University due to COVID, some administrative details, various management changes at the SBU leadership conspired. **Leadership issues now settled, Abhay (+DK) will approach the new SBU Leadership shortly.**

Summary

- Despite COVID, 2020 has been a good year for CFNS:
 - Lots of scientific output from young scientists
 - Good mentorship leading to many graduations and promotions
 - Significant contributions to the EICUG Yellow Report → new Physics at the EIC and the detector/IR design
- Most of the IAC recommendations from 2019 have been addressed. The two remaining items deal with transition from COVID related issues at SBU & organizational issues at BNL: To be addressed
- CFNS worked closely with the EICUG post CD0 (Yellow Reports), will continue into the future to help form collaborations and further develop EIC-related science and possibly planning of the “other IR”.
- There is good communication with EIC²@JLab. The new Center for Nuclear Femtography (CNF) presents opportunity for future collaboration including possible joint funding initiatives.